

SEQUENCE LISTING

<110> Hughes, Martin J G
 Santangelo, Joseph D
 Lane, Jonathan D
 Feldman, Robert
 Moore, Joanne C
 Dobson, Richard J
 Everest, Paul
 Henwood, Caroline J
 Dougan, Gordon
 Wilson, Rebecca K

<120> Outer Surface Proteins, Their Genes, and Their Use

<130> GJE-71

<140> US 09/868,195

<141> 2001-06-15

<160> 12

<170> PatentIn version 3.1

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Asn Asp Ile Gln Leu Gly Lys Lys Glu Ser Thr Glu Asp Thr Ala Lys	
85 90 95	
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Val Leu Gly Arg Met Phe Asp Gly Ile Glu Phe Arg Gly Phe Ser Gln	
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Arg Met Val Glu Glu Leu Ala Glu Phe Ser Gly Val Pro Val Trp Asn	
115 120 125	
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Gly Leu Thr Asp Glu Trp His Pro Thr Gln Met Leu Ala Asp Tyr Leu	
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Thr Ile Lys Glu Asn Phe Gly Lys Leu Glu Gly Ile Thr Leu Val Tyr	
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Cys Gly Asp Gly Arg Asn Asn Val Ala Asn Ser Leu Leu Val Ala Gly	
165 170 175	
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Thr Leu Met Gly Val Asn Val His Ile Phe Ser Pro Lys Glu Leu Phe	
180 185 190	
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225 230 235 240	
aag ttc aaa gaa cgc gtt gaa ctt ctt caa cca tat caa gta aac atg	768
Lys Phe Lys Glu Arg Val Glu Leu Leu Gln Pro Tyr Gln Val Asn Met	
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gaa ctg att aaa aaa gct aat aat gat aat ctt atc ttc tta cac tgc	816
Glu Leu Ile Lys Lys Ala Asn Asn Asp Asn Leu Ile Phe Leu His Cys	
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tta cct gca ttc cat gat aca aat acc gtt tat ggc aaa gac gtc gct	864
Leu Pro Ala Phe His Asp Thr Asn Thr Val Tyr Gly Lys Asp Val Ala	
275 280 285	
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 180 185 190

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 195 200 205

Gly Ala His Val Leu Val Thr Asp Asn Val Asp Glu Ala Val Lys Gly
 210 215 220

Ala Asp Val Phe Tyr Thr Asp Val Trp Val Ser Met Gly Glu Glu Asp
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 245 250 255

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 260 265 270

Leu Pro Ala Phe His Asp Thr Asn Thr Val Tyr Gly Lys Asp Val Ala
 275 280 285

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 290 295 300

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Leu Val Arg Val Asp Phe Asn Val Pro Leu Lys Asp Gly Val Ile Thr	
20 25 30	
aac gac aac cgt atc act gcg gct ctt cca aca atc aag tat atc atc	144
Asn Asp Asn Arg Ile Thr Ala Ala Leu Pro Thr Ile Lys Tyr Ile Ile	
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gaa caa ggt ggt cgt gct atc ctc ttc tct cac ctt gga cgt gtt aaa	192
Glu Gln Gly Gly Arg Ala Ile Leu Phe Ser His Leu Gly Arg Val Lys	
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tta gct gct aaa ctt ggt caa gat gtt gta ttc cca ggt gtt act cgt	288
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85 90 95	
ggt gca aaa tta gaa gaa gca atc aat gct ttg gaa gat gga caa gtt	336
Gly Ala Lys Leu Glu Glu Ala Ile Asn Ala Leu Glu Asp Gly Gln Val	
100 105 110	
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Leu Leu Val Glu Asn Thr Arg Phe Glu Asp Val Asp Gly Lys Lys Glu	
115 120 125	
tct aag aat gac gaa gaa ctt ggt aaa tac tgg gct tca ctt gga gat	432
Ser Lys Asn Asp Glu Glu Leu Gly Lys Tyr Trp Ala Ser Leu Gly Asp	
130 135 140	
gga atc ttc gtt aac gat gca ttt ggt aca gca cac cgt gct cat gca	480
Gly Ile Phe Val Asn Asp Ala Phe Gly Thr Ala His Arg Ala His Ala	
145 150 155 160	
tca aac gta ggt att tca gca aac gtt gaa aaa gct gta gct ggt ttc	528
Ser Asn Val Gly Ile Ser Ala Asn Val Glu Lys Ala Val Ala Gly Phe	
165 170 175	
ctt ctt gaa aac gaa att gct tac atc caa gaa gca gtt gaa act cca	576
Leu Leu Glu Asn Glu Ile Ala Tyr Ile Gln Glu Ala Val Glu Thr Pro	
180 185 190	
gaa cgc cca ttc gta gct att ctt ggt ggc tca aaa gtt tct gat aag	624
Glu Arg Pro Phe Val Ala Ile Leu Gly Gly Ser Lys Val Ser Asp Lys	
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 Gly Asn Ser Leu Val Glu Glu Asp Lys Leu Asp Val Ala Lys Asp Leu
 245 250 255

ctt gaa aaa tca aac ggt aaa ttg atc ttg cca gtt gac tca aaa gaa 816
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 260 265 270

gca aac gca ttt gct ggt tat act gaa gtt cgc gac act gaa ggt gaa 864
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 275 280 285

gca gtt tca gaa ggg ttc ctt ggt ctt gac atc ggt cct aaa tca atc 912
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 290 295 300

gct aaa ttt gat gaa gca ctt act ggt gct aaa aca gtt gta tgg aac 960
 Ala Lys Phe Asp Glu Ala Leu Thr Gly Ala Lys Thr Val Val Trp Asn
 305 310 315 320

gga cct atg ggt gtc ttt gaa aac cct gac ttc caa gct ggt aca atc 1008
 Gly Pro Met Gly Val Phe Glu Asn Pro Asp Phe Gln Ala Gly Thr Ile
 325 330 335

ggt gta atg gac gct atc gtt aaa caa cca ggc gtt aaa tca atc atc 1056
 Gly Val Met Asp Ala Ile Val Lys Gln Pro Gly Val Lys Ser Ile Ile
 340 345 350

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 355 360 365

aaa ttc tca tgg atc tct act ggt ggt gga gca agc atg gaa ttg ctc 1152
 Lys Phe Ser Trp Ile Ser Thr Gly Gly Gly Ala Ser Met Glu Leu Leu
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Glu Gln Gly Gly Arg Ala Ile Leu Phe Ser His Leu Gly Arg Val Lys	50	55	60
Glu Glu Ala Asp Lys Glu Gly Lys Ser Leu Ala Pro Val Ala Ala Asp	65	70	75
Leu Ala Ala Lys Leu Gly Gln Asp Val Val Phe Pro Gly Val Thr Arg	85	90	95
Gly Ala Lys Leu Glu Glu Ala Ile Asn Ala Leu Glu Asp Gly Gln Val	100	105	110
Leu Leu Val Glu Asn Thr Arg Phe Glu Asp Val Asp Gly Lys Lys Glu	115	120	125
Ser Lys Asn Asp Glu Glu Leu Gly Lys Tyr Trp Ala Ser Leu Gly Asp	130	135	140
Gly Ile Phe Val Asn Asp Ala Phe Gly Thr Ala His Arg Ala His Ala	145	150	155
Ser Asn Val Gly Ile Ser Ala Asn Val Glu Lys Ala Val Ala Gly Phe	165	170	175
Leu Leu Glu Asn Glu Ile Ala Tyr Ile Gln Glu Ala Val Glu Thr Pro	180	185	190
Glu Arg Pro Phe Val Ala Ile Leu Gly Gly Ser Lys Val Ser Asp Lys	195	200	205
Ile Gly Val Ile Glu Asn Leu Leu Glu Lys Ala Asp Lys Val Leu Ile	210	215	220
Gly Gly Gly Met Thr Tyr Thr Phe Tyr Lys Ala Gln Gly Ile Glu Ile	225	230	235
			240

Gly Asn Ser Leu Val Glu Glu Asp Lys Leu Asp Val Ala Lys Asp Leu
 245 250 255

Leu Glu Lys Ser Asn Gly Lys Leu Ile Leu Pro Val Asp Ser Lys Glu
 260 265 270

Ala Asn Ala Phe Ala Gly Tyr Thr Glu Val Arg Asp Thr Glu Gly Glu
 275 280 285

Ala Val Ser Glu Gly Phe Leu Gly Leu Asp Ile Gly Pro Lys Ser Ile
 290 295 300

Ala Lys Phe Asp Glu Ala Leu Thr Gly Ala Lys Thr Val Val Trp Asn
 305 310 315 320

Gly Pro Met Gly Val Phe Glu Asn Pro Asp Phe Gln Ala Gly Thr Ile
 325 330 335

Gly Val Met Asp Ala Ile Val Lys Gln Pro Gly Val Lys Ser Ile Ile
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Gly Gly Gly Asp Ser Ala Ala Ala Ala Ile Asn Leu Gly Arg Ala Asp
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 Gly Glu His Glu Leu Asp Tyr Leu Pro Pro Gln Val Ser Ala Ala Asp
 20 25 30

gct ttc ctt cgt caa ggg act ggt cct gga tca gat ttt ctc gga tgg 144
 Ala Phe Leu Arg Gln Gly Thr Gly Pro Gly Ser Asp Phe Leu Gly Trp
 35 40 45

atg gaa cct cca gaa aac tat gac aaa gaa gaa ttt tct cgc att caa 192
 Met Glu Pro Pro Glu Asn Tyr Asp Lys Glu Glu Phe Ser Arg Ile Gln
 50 55 60

aaa gcc gct gaa aag att aaa tca gat agc gaa gta ctc gtg gtt att 240
 Lys Ala Ala Glu Lys Ile Lys Ser Asp Ser Glu Val Leu Val Val Ile
 65 70 75 80

ggt att ggt ggt tcg tac ctt ggt gca aaa gca gca att gac ttt ttg 288
 Gly Ile Gly Gly Ser Tyr Leu Gly Ala Lys Ala Ala Ile Asp Phe Leu
 85 90 95

aat aat cat ttt gct aat ttg caa acc gca gaa gaa cgt aaa gcg cct 336
 Asn Asn His Phe Ala Asn Leu Gln Thr Ala Glu Glu Arg Lys Ala Pro
 100 105 110

cag att ctt tat gct gga aat tct att tca tct act tac ctt gcc gat 384
 Gln Ile Leu Tyr Ala Gly Asn Ser Ile Ser Ser Thr Tyr Leu Ala Asp
 115 120 125

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 130 135 140

aaa tca ggt aca aca act gaa cca gcg att gct ttc cgt gta ttt aaa 480
 Lys Ser Gly Thr Thr Thr Glu Pro Ala Ile Ala Phe Arg Val Phe Lys
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 35 40 45

Met Glu Pro Pro Glu Asn Tyr Asp Lys Glu Glu Phe Ser Arg Ile Gln
 50 55 60

Lys Ala Ala Glu Lys Ile Lys Ser Asp Ser Glu Val Leu Val Val Ile
 65 70 75 80

Gly Ile Gly Gly Ser Tyr Leu Gly Ala Lys Ala Ala Ile Asp Phe Leu
 85 90 95

Asn Asn His Phe Ala Asn Leu Gln Thr Ala Glu Glu Arg Lys Ala Pro
 100 105 110

Gln Ile Leu Tyr Ala Gly Asn Ser Ile Ser Ser Thr Tyr Leu Ala Asp
 115 120 125

Leu Val Glu Tyr Val Gln Asp Lys Glu Phe Ser Val Asn Val Ile Ser
 130 135 140

Lys Ser Gly Thr Thr Thr Glu Pro Ala Ile Ala Phe Arg Val Phe Lys
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 Asp Phe Val Asn Lys Lys Ala Thr Asp Gly Val Leu Leu Ala His Thr
 20 25 30

gat ggt ggg gtt cca aat atg ttt gta acg ctt cct aca caa gac gct 144

Asp Gly Gly Val Pro Asn Met Phe Val Thr Leu Pro Thr Gln Asp Ala
 35 40 45
 tac act ctt ggt tac act att tac ttc ttt gag tta gca att ggc ctt 192
 Tyr Thr Leu Gly Tyr Thr Ile Tyr Phe Phe Glu Leu Ala Ile Gly Leu
 50 55 60
 tca ggt tat ctt aac tca gta aat cca ttt gat caa ccg ggg gta gaa 240
 Ser Gly Tyr Leu Asn Ser Val Asn Pro Phe Asp Gln Pro Gly Val Glu
 65 70 75 80
 gca tat aaa cgt aat atg ttc gca ttt ggt aaa cct gga ttc gaa gag 288
 Ala Tyr Lys Arg Asn Met Phe Ala Phe Gly Lys Pro Gly Phe Glu Glu
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 ctt agc gct gaa ttg aat gca cgt ctt taa 318
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 Tyr Thr Leu Gly Tyr Thr Ile Tyr Phe Phe Glu Leu Ala Ile Gly Leu
 50 55 60
 Ser Gly Tyr Leu Asn Ser Val Asn Pro Phe Asp Gln Pro Gly Val Glu
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Lys	Gly	Val	Thr	Ala	Pro	Glu	Phe	Gly	Leu	Ile	Leu	Gly	Ser	Gly	Leu	
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gga	gaa	ttg	gct	gaa	gaa	atc	gaa	aat	cct	att	gtt	gtg	gat	tat	gca	144
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Asp	Ile	Pro	Asn	Trp	Gly	Gln	Ser	Thr	Val	Val	Gly	His	Ala	Gly	Lys	
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Phe	Ser	Val	Trp	Asp	Leu	Ser	Gly	Arg	Lys	Val	Leu	Ala	Leu	Gln	Gly	
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Val	Arg	Ile	Met	Arg	Ala	Leu	Ala	Cys	His	Ser	Val	Leu	Val	Thr	Asn	
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Glu	Glu	Phe	Gly	Pro	Arg	Phe	Pro	Asp	Met	Ser	Asp	Ala	Tyr	Thr	Ala	
145					150				155						160	
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Thr	Tyr	Arg	Gln	Lys	Ala	His	Gln	Ile	Ala	Glu	Asn	Asp	Ile	Lys	Leu	
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 195 200 205

tcc acg gtt cca gag gtg atc gtt gca gct cac tca ggg ctt aaa gtg 672
 Ser Thr Val Pro Glu Val Ile Val Ala Ala His Ser Gly Leu Lys Val
 210 215 220

tta gga att tca gca att act aac ctt gcc gct ggc ttc caa tca gag 720
 Leu Gly Ile Ser Ala Ile Thr Asn Leu Ala Ala Gly Phe Gln Ser Glu
 225 230 235 240

ctc aat cat gag gag gtc gtt gaa gtt act cag cgt att aaa gaa gat 768
 Leu Asn His Glu Glu Val Val Glu Val Thr Gln Arg Ile Lys Glu Asp
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 35 40 45

Asp Ile Pro Asn Trp Gly Gln Ser Thr Val Val Gly His Ala Gly Lys
 50 55 60

Phe Ser Val Trp Asp Leu Ser Gly Arg Lys Val Leu Ala Leu Gln Gly
 65 70 75 80

Arg Phe His Phe Tyr Glu Gly Asn Thr Met Glu Val Val Thr Phe Pro
 85 90 95

Val Arg Ile Met Arg Ala Leu Ala Cys His Ser Val Leu Val Thr Asn
 100 105 110

Ala Ala Gly Gly Ile Gly Tyr Gly Pro Gly Thr Leu Met Leu Ile Lys
 115 120 125

Asp His Ile Asn Met Ile Gly Thr Asn Pro Leu Ile Gly Glu Asn Leu
 130 135 140

Glu Glu Phe Gly Pro Arg Phe Pro Asp Met Ser Asp Ala Tyr Thr Ala
 145 150 155 160

Thr Tyr Arg Gln Lys Ala His Gln Ile Ala Glu Asn Asp Ile Lys Leu
 165 170 175

Glu Glu Gly Val Tyr Leu Gly Val Ser Gly Pro Thr Tyr Glu Thr Pro
 180 185 190

Ala Glu Ile Arg Ala Phe Gln Thr Met Gly Ala Gln Ala Val Gly Met
 195 200 205

Ser Thr Val Pro Glu Val Ile Val Ala Ala His Ser Gly Leu Lys Val
 210 215 220

Leu Gly Ile Ser Ala Ile Thr Asn Leu Ala Ala Gly Phe Gln Ser Glu
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Val	Asn	Gln	Ile	Glu	Ile	Leu	Ser	Pro	Ile	Asp	Asp	Ser	Ser	Leu	Gly		
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Phe	Val	Pro	Ala	Met	Thr	Arg	Glu	Glu	Val	Asp	His	Ala	Met	Lys	Ala		
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ggt	cgt	gag	gct	tta	cca	gct	tgg	gct	gct	tta	aca	gta	tat	gaa	cgt	192	
Gly	Arg	Glu	Ala	Leu	Pro	Ala	Trp	Ala	Ala	Leu	Thr	Val	Tyr	Glu	Arg		
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gca	caa	tac	ctt	cat	aaa	gcc	gca	gac	att	att	gaa	cgt	gat	aaa	gaa	240	
Ala	Gln	Tyr	Leu	His	Lys	Ala	Ala	Asp	Ile	Ile	Glu	Arg	Asp	Lys	Glu		
65					70				75						80		
gaa	att	gct	act	gtt	tta	gca	aaa	gaa	att	tct	aaa	gct	tac	aat	gct	288	
Glu	Ile	Ala	Thr	Val	Leu	Ala	Lys	Glu	Ile	Ser	Lys	Ala	Tyr	Asn	Ala		
			85					90						95			
tca	gta	act	gag	gtt	gta	agg	aca	gct	gat	ctt	att	cgt	tat	gca	gca	336	
Ser	Val	Thr	Glu	Val	Val	Arg	Thr	Ala	Asp	Leu	Ile	Arg	Tyr	Ala	Ala		
			100					105					110				
gaa	gaa	gga	att	cgt	tta	tca	act	tca	gct	gac	gaa	ggt	gga	aaa	atg	384	
Glu	Glu	Gly	Ile	Arg	Leu	Ser	Thr	Ser	Ala	Asp	Glu	Gly	Gly	Lys	Met		
		115					120					125					
gat	gct	tca	aca	ggt	cat	aag	ttg	gct	gtt	att	cgt	cgt	caa	cca	gta	432	
Asp	Ala	Ser	Thr	Gly	His	Lys	Leu	Ala	Val	Ile	Arg	Arg	Gln	Pro	Val		
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ggt	atc	gtt	tta	gca	atc	gca	cct	tat	aat	tac	cct	gtt	aac	ctc	tca	480	
Gly	Ile	Val	Leu	Ala	Ile	Ala	Pro	Tyr	Asn	Tyr	Pro	Val	Asn	Leu	Ser		
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Gly	Ser	Lys	Ile	Ala	Pro	Ala	Leu	Ile	Gly	Gly	Asn	Val	Val	Met	Phe		
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aaa	cca	cca	aca	caa	ggt	tca	gtc	tca	gga	ctt	gtt	tta	gca	aaa	gct	576	
Lys	Pro	Pro	Thr	Gln	Gly	Ser	Val	Ser	Gly	Leu	Val	Leu	Ala	Lys	Ala		
			180					185					190				
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Phe	Ala	Glu	Ala	Gly	Leu	Pro	Ala	Gly	Val	Phe	Asn	Thr	Ile	Thr	Gly		
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cgc	ggt	tct	gag	att	gga	gat	tac	att	gtt	gag	cat	gaa	gaa	gtt	aat	672	
Arg	Gly	Ser	Glu	Ile	Gly	Asp	Tyr	Ile	Val	Glu	His	Glu	Glu	Val	Asn		
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cgt gtg ctt gtc gtt gaa gaa gtt gcw gat gaa ttg gca gaa aaa ata Arg Val Leu Val Val Glu Glu Val Ala Asp Glu Leu Ala Glu Lys Ile 290 295 300			912
tct gaa aat gta gca aaa tta tca gta ggt gat cca ttt gat aat gca Ser Glu Asn Val Ala Lys Leu Ser Val Gly Asp Pro Phe Asp Asn Ala 305 310 315 320			960
acg gtg aca ccg gtt att gat gat aat tca gct gac ttt att gaa agc Thr Val Thr Pro Val Ile Asp Asp Asn Ser Ala Asp Phe Ile Glu Ser 325 330 335			1008
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aaa cgt gat ggt cgt cta tta act cca gga ttg ttt gat cat gtt act Lys Arg Asp Gly Arg Leu Leu Thr Pro Gly Leu Phe Asp His Val Thr 355 360 365			1104
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tct gat ttt gga tta caa tca tca gtc ttt aca cgt gat ttc caa aaa Ser Asp Phe Gly Leu Gln Ser Ser Val Phe Thr Arg Asp Phe Gln Lys 405 410 415			1248
gca ttt gat ata gca aat aaa ctt gaa gtt ggt aca gtt cac att aac Ala Phe Asp Ile Ala Asn Lys Leu Glu Val Gly Thr Val His Ile Asn 420 425 430			1296
aat aag act gga cgt ggt ccw gat aat ttc cca ttc tta gga ctc aaa Asn Lys Thr Gly Arg Gly Pro Asp Asn Phe Pro Phe Leu Gly Leu Lys 435 440 445			1344
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 35 40 45

Gly Arg Glu Ala Leu Pro Ala Trp Ala Ala Leu Thr Val Tyr Glu Arg
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Ala Gln Tyr Leu His Lys Ala Ala Asp Ile Ile Glu Arg Asp Lys Glu
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Glu Ile Ala Thr Val Leu Ala Lys Glu Ile Ser Lys Ala Tyr Asn Ala
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Ser Val Thr Glu Val Val Arg Thr Ala Asp Leu Ile Arg Tyr Ala Ala
 100 105 110

Glu Glu Gly Ile Arg Leu Ser Thr Ser Ala Asp Glu Gly Gly Lys Met
 115 120 125

Asp Ala Ser Thr Gly His Lys Leu Ala Val Ile Arg Arg Gln Pro Val
 130 135 140

Gly Ile Val Leu Ala Ile Ala Pro Tyr Asn Tyr Pro Val Asn Leu Ser
 145 150 155 160

Gly Ser Lys Ile Ala Pro Ala Leu Ile Gly Gly Asn Val Val Met Phe
 165 170 175

Lys Pro Pro Thr Gln Gly Ser Val Ser Gly Leu Val Leu Ala Lys Ala
 180 185 190

Phe Ala Glu Ala Gly Leu Pro Ala Gly Val Phe Asn Thr Ile Thr Gly
 195 200 205

Arg Gly Ser Glu Ile Gly Asp Tyr Ile Val Glu His Glu Glu Val Asn
 210 215 220

Phe Ile Asn Phe Thr Gly Ser Thr Pro Val Gly Gln Arg Ile Gly Lys
 225 230 235 240

Leu Ala Gly Met Arg Pro Ile Met Leu Glu Leu Gly Gly Lys Asp Ala
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Gly Ile Val Leu Ala Asp Ala Asp Leu Asp Asn Ala Ala Lys Gln Ile
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Val Ala Gly Ala Tyr Asp Tyr Ser Gly Gln Arg Cys Thr Ala Ile Lys
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Arg Val Leu Val Val Glu Glu Val Ala Asp Glu Leu Ala Glu Lys Ile
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Thr Val Thr Pro Val Ile Asp Asp Asn Ser Ala Asp Phe Ile Glu Ser
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Lys Arg Asp Gly Arg Leu Leu Thr Pro Gly Leu Phe Asp His Val Thr
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Leu Asp Met Lys Leu Ala Trp Glu Glu Pro Phe Gly Pro Ile Leu Pro
 370 375 380

Ile Ile Arg Val Lys Asp Ala Glu Glu Ala Val Ala Ile Ala Asn Lys
 385 390 395 400

Ser Asp Phe Gly Leu Gln Ser Ser Val Phe Thr Arg Asp Phe Gln Lys
 405 410 415

Ala Phe Asp Ile Ala Asn Lys Leu Glu Val Gly Thr Val His Ile Asn

420

425

430

Asn Lys Thr Gly Arg Gly Pro Asp Asn Phe Pro Phe Leu Gly Leu Lys
435 440 445

Gly Ser Gly Ala Gly Val Gln Gly Ile Arg Tyr Ser Ile Glu Ala Met
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Thr Asn Val Lys Ser Ile Val Leu Asp Met Lys
465 470 475

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